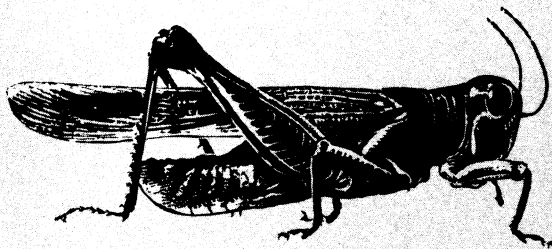
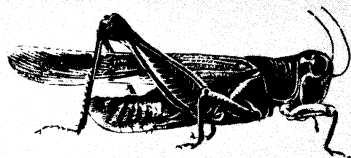
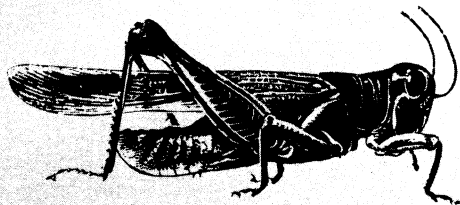


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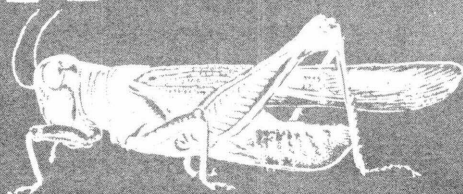
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Grasshopper Control

Grasshopper Control



Grasshoppers are found in every part of the United States, but serious outbreaks seldom develop east of the Mississippi River; they occur mostly in the western two-thirds of the country.

Grasshoppers often severely damage range grasses. They also contribute to soil erosion and "dust-bowl" conditions. Their feeding is one of the principal reasons for loss of productive grasslands in many of the Western States.

Many cultivated crops are also damaged by grasshoppers. When range grass is scarce and outbreaks are severe, grasshoppers often migrate into and severely damage the foliage of alfalfa, clover, corn, small grains, tobacco, sugarbeets, cotton, lettuce, potatoes, and fruit trees. In fruit orchards, grasshoppers sometimes completely strip the leaves and may kill young trees.

You can control grasshoppers by applying insecticides. If your farming practices will permit, cultural measures can be used to help keep grasshoppers in check.

SELECTING INSECTICIDES

Insecticides differ widely in their chemical properties. When selecting an insecticide, be sure that it is best suited for your needs.

Insecticides from a group known as *chlorinated hydrocarbons* are sometimes used for control of grasshoppers. These insecticides are very effective, but they can leave residues on crops and pasture forage. Toxaphene is one of this group recommended to control grasshoppers.

A second group, the *organophosphates*, includes diazinon, naled, malathion, and mevinphos. These are also highly effective against grasshoppers and, if properly used, do not leave harmful residues. However, their killing properties do not last as long as the chlorinated hydrocarbons.

A third group, the *carbamates*, includes carbaryl, which is the most widely known. Carbaryl gives adequate control of grasshoppers and

has about the same residual life as the organophosphates.

APPLYING SPRAYS

Emulsifiable concentrates and wettable powders can be obtained in various strengths from insecticide dealers.

The emulsifiable concentrates or wettable powders should be mixed with a sufficient amount of water to insure that the spraying equipment will deliver the desired amount of active ingredient per acre.

Before applying a spray, read the instructions that follow under "Dosages," "Application Procedures," and "Precautions."

Dosages

The accompanying guide shows insecticides to apply for grasshopper control, the crops on which they are recommended, dosages per acre, and waiting periods between treatment and harvest or feeding.

Use the low dosages to kill young grasshoppers in short, dense, succulent vegetation and on open stands of taller growth where long-continued killing action is not essential.

Use up to the high dosages for sprays when vegetation is tall and dense, or when the grasshoppers are adults.

The high dosages may be needed also in the treatment of barrier strips, or for late-season use when vegetation is maturing, tempera-

DOSAGE RECOMMENDATIONS

Dosages recommended in this publication should not be expected to cover all local conditions within the many States where grasshopper control is needed. They are offered as a guide to help you solve your own problems. If you are in doubt, consult your county agricultural agent or one of your Extension or State entomologists.

tures are high, and grasshoppers are fully grown.

Low-volume sprays.—You can control grasshoppers by applying as little as 8 fluid ounces of undiluted technical malathion (10.24 oz. of actual malathion) per acre. Low-volume sprays are more economical than emulsifiable concentrates, but to use them successfully, your equipment must be capable of dispensing the smaller amounts. Both ground and air equipment can be adapted to low-volume spraying. To obtain proper dosages and thorough coverage, your equipment must be accurately calibrated, and the sprays



BN-17623-X

The migratory grasshopper, "*Melanoplus sanguinipes*," probably the most widespread of all grasshopper species.

carefully applied. (For more information concerning equipment design for low-volume spraying, consult your local, State, or Federal pest control official.)

Application Procedures

The recommended insecticides are most effective when applied evenly, at the right time, and in the right

GUIDE FOR SELECTING AND USING INSECTICIDES ¹

Insecticide	Amount of active ingredient to apply per acre (ounces)	Crops on which recommended	Minimum number of days from application to harvest, grazing, or feeding
Carbaryl.....	8 to 16.....	Alfalfa, clover.....	0.
		Corn.....	0.
		Range and pasture.....	0.
		Ungrazed areas.....	---
		Apple, pear.....	1.
		Peach, apricot.....	3.
		Cotton ²	0.
		Sugarbeets.....	14.
		Lettuce.....	14.
		Alfalfa.....	4, grazing; 10, if cut for hay.
Diazinon.....	8 to 12.....	Clover.....	7.
		Corn.....	2.
Malathion.....	12 to 16 ³	Alfalfa, clover.....	0.
		Corn.....	5.
		Small grains.....	7.
		Range and pasture.....	0.
		Ungrazed areas.....	---
		Apple.....	3.
		Pear.....	1.
		Peach, apricot.....	7.
		Cotton ²	0.
		Sugarbeets.....	7.
		Tobacco.....	---
		Potatoes.....	0.
		Lettuce:	
		Leaf.....	14.
		Head.....	7.
Mevinphos ⁴	4 to 8.....	Alfalfa, clover.....	1.
Naled.....	8 to 12.....	Alfalfa, clover.....	4.
Toxaphene ⁵	16 to 24 (in water).	Corn.....	(⁵).
		Small grains.....	(⁵).
		Cotton ²	(⁵).

¹ See "Precautions," p. 7.

² For effective control on cotton, 1 to 2 pounds of carbaryl, 1 to 2 pounds of malathion, or 2 to 4 pounds of toxaphene may be needed.

³ If your equipment will apply low-volume dosages, see instructions for using 8 ounces of technical malathion per acre, p. 3.

⁴ See p. 8 for precautions on mevinphos.

⁵ See p. 8 for restrictions in feeding and grazing.

place. They may be applied with ground equipment or by aircraft.

Application equipment should be carefully adjusted to give the desired rate of output. Too much insecticide is wasteful, and it increases the danger of harmful residues. Too little insecticide is also wasteful, because it will not prevent crop losses. Areas treated with less-than-effective dosages will need to be re-treated if control is to be obtained.

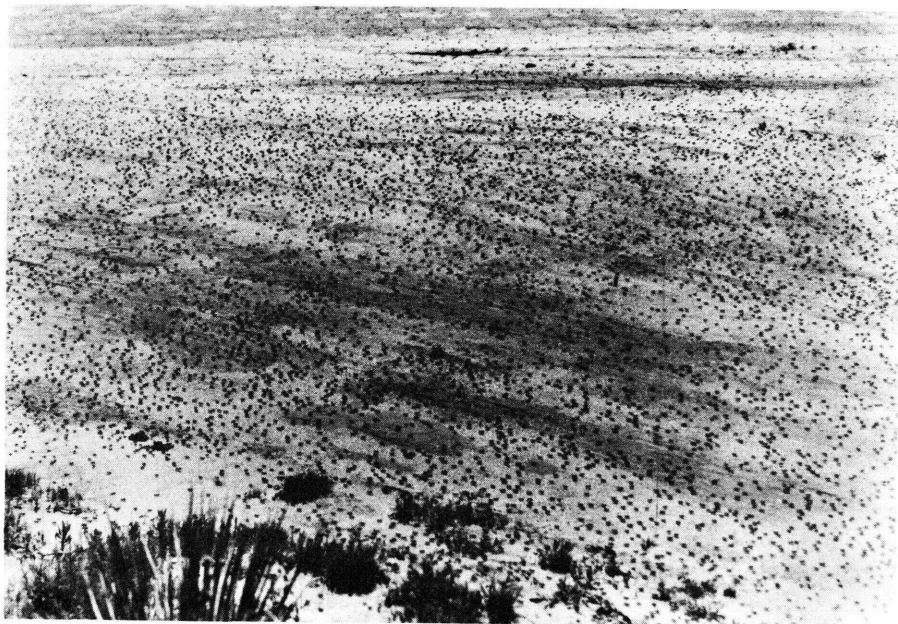
If you use the insecticides in the guide (p. 4), follow this procedure:

Determine the location of threatening infestations of young grasshoppers in relation to the location of your fields planted to crops. Look along roadsides, canal banks and field margins, in idle areas border-

ing cultivated fields, and in the fields themselves.

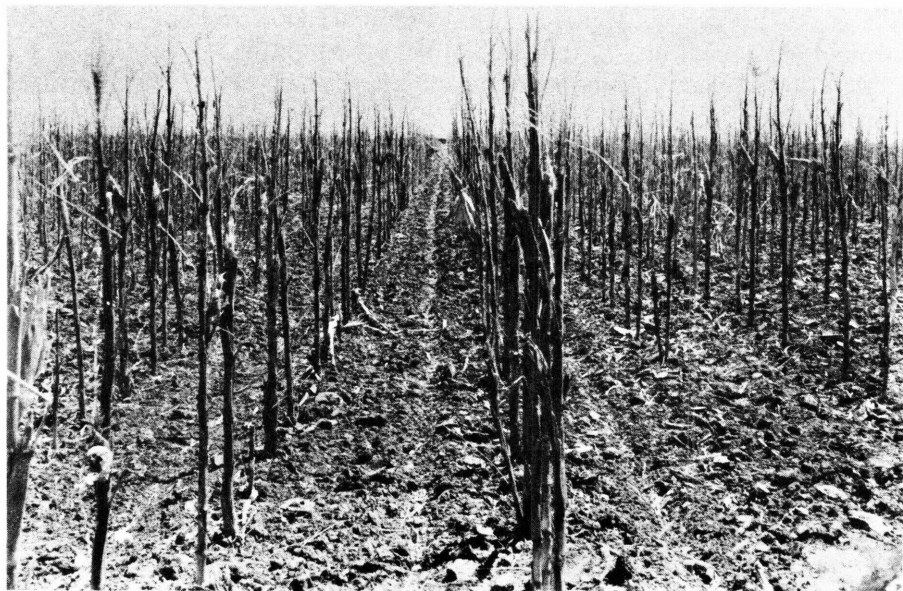
Spray these places when the main hatch is completed or when the young grasshoppers begin to move off the hatching grounds. This early treatment will greatly reduce the amount of acreage that otherwise might have to be treated later. Grasshoppers that damage row crops usually hatch in field margins. Timely treatment of vegetation in these margins will destroy the pests before they move into the fields.

Alfalfa.—When an entire alfalfa field is severely infested, it usually is most economical to cut the alfalfa and then apply an insecticide to protect the next cutting. Spray field



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Grasshoppers sometimes gather in swarms and migrate hundreds of miles.



BN-17622-X

Grasshopper damage to tall corn. In severe outbreaks, stalks may be eaten to the ground.

margins, ditchbanks, patches of weeds, and uncut strips of alfalfa where grasshoppers have concentrated.

Grasshoppers often hatch in large numbers after the first crop has been harvested. To control these insects, spray the next crop before the new growth is 6 inches high; this will protect the new growth.

Clover.—Treat clover fields when the grasshoppers are young. Carefully observe fields after treatment, and make a second application if necessary.

Corn.—To prevent grasshoppers from damaging corn, spray the margins of cornfields and adjacent infested small-grain fields or weed patches when the small grains begin to mature.

Cotton.—To protect cotton, spray nearby wasteland from which grasshoppers are migrating. If cotton plants become infested, spray as soon as you detect damage.

Fruit crops.—Spray the ground cover and fence rows as soon as grasshoppers become numerous and before they migrate to the trees.

Small grains.—To protect small grains, spray hatching areas when the nymphs first appear. To prevent damage to fall-seeded grain, spray the field margins and as far into the field as the grasshoppers have moved.

Sugarbeets, tobacco, lettuce, and potatoes.—Treat hatching areas, infested fence rows, idle land and roadways adjoining the crops to de-

stroy grasshoppers before they move into the fields.

Range and pasture.—More than 100 species of grasshoppers may be found on range and pasture. Begin sprays when hatching of the most numerous species is completed, and finish before the pests begin to lay eggs.

Ungrazed areas.—Treatment of wastelands, roadsides, and conservation reserves is important to hold down migrations. Protecting the current year's field crops and range forage is not the sole aim of grasshopper control. If all infestations in a neighborhood are reduced to less than one grasshopper per square yard, further control measures will not be needed for several years unless the fields become reinfested through migrations.

Precautions

Pesticides used improperly can be injurious to man, animals, and

plants. Follow the directions and heed all precautions on the labels.

Store pesticides in original containers under lock and key—out of the reach of children and animals—and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish, and wildlife. Do not apply pesticides when there is danger of drift, when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment if specified on the container.

If your hands become contaminated with a pesticide, do not eat or drink until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first aid treatment given on the label, and get prompt medical attention. If a pes-



EPQ-1350

Mist blower mounted on a truck for use in grasshopper control.

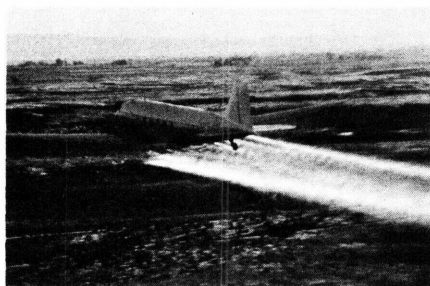
ticide is spilled on your skin or clothing, remove clothing immediately and wash skin thoroughly.

Do not clean spray equipment or dump excess spray material near ponds, streams, or wells. Because it is difficult to remove all traces of herbicides from equipment, do not use the same equipment for insecticides or fungicides that you use for herbicides.

Dispose of empty pesticide containers promptly. Have them buried at a sanitary land-fill dump, or crush and bury them in a level, isolated place.

Mevinphos.—Mevinphos is highly toxic and may cause death if swallowed, inhaled, or absorbed through the skin. It should be applied only by persons thoroughly familiar with its hazards and who will assume full responsibility for its safe use and comply with all precautions on the container label. When applying mevinphos, wear a respirator of a type that has been tested and found satisfactory by the U.S. Department of Agriculture. A list of acceptable respiratory protective devices is available from the Entomology Research Division, Agricultural Research Service, Beltsville, Md. 20705.

Toxaphene.—Do not graze dairy animals or animals being finished for slaughter in corn, grain, or cotton fields treated with toxaphene. Do not feed the animals forage, including silage and gin waste, from



BN-29209

Applying spray by airplane.

such fields. Do not use toxaphene near lakes, streams, or ponds.

Carbaryl.—Give advance notice to beekeepers whose apiaries are within or adjacent to areas to be treated with carbaryl. The use of carbaryl on fruit trees has been associated with a rapid buildup of spider mites and aphids.

NOTE: Some States have restrictions on the use of certain pesticides. Check your State and local regulations. Also, because registrations of pesticides are under constant review by the U.S. Department of Agriculture, consult your county agricultural agent or State Extension specialist to be sure the intended use is still registered.

CULTURAL PRACTICES

Grasshoppers, particularly those that lay their eggs in fields planted to crops, may be controlled to some extent by tillage and seeding operations and by other cultural measures. Use these measures only if they are consistent with approved

farming practices in your community.

Cultural operations do not eliminate the need for insecticides, but they reduce the amount of chemicals needed and make their application easier.

Tillage

Working the soil kills grasshoppers in several ways. It can bury their eggs so deep that young grasshoppers do not hatch. It can bring the eggs to the surface where they are destroyed by the drying action of sun and wind. It is also a means of discouraging egg laying, preventing dispersal of the pests, and forcing grasshoppers scattered over a field to concentrate in a small area.

Proper tillage before eggs have hatched often gives excellent control of light or threatening grain-stubble infestations.

Fall tillage is preferable, but spring tillage sometimes is just as effective. Tillage right after harvest will make the soil unattractive to egg laying, and will assist in destroying eggs already laid.

In determining the time of tillage and the implement to use, consider not only grasshopper control but also the tillage effect on soil drift, weed control, and soil moisture.

Moldboard plowing, 5 or more inches deep, followed by packing, is the best method to prevent the emergence of young grasshoppers in areas where soils are heavy and soil blowing is not a problem.

Shallow cultivation is less effective than moldboard plowing, but

it will destroy many of the eggs by exposing them to sun and wind. The one-way disk is the best implement for this operation. The duck-foot cultivator, the single or double harrow, and the one-way disk harrow, are satisfactory. "Blade" tillers used in "stubble-mulch" farming are less effective than the others. Shallow cultivation is most effective during dry weather, when the egg-drying effects of sun and wind are greatest.

Grasshopper-infested grain stubble that is to be summer-fallowed should be worked before the eggs hatch. If tillage is delayed until after the young grasshoppers appear, it still can be used to prevent them from moving to nearby crops. This tillage can be accomplished by cultivating a guard strip 3 rods wide around the entire field. If the strip is kept cleanly fallowed, the young grasshoppers can usually be held within the field for a week or two. There may be time to complete tillage operations before they escape.

Tillage done after the establishment of the guard strip should start next to the strip and should extend until only a small block of unworked stubble remains in the center of the field. The grasshoppers will then be concentrated in this small area. They can be killed with insecticide at much less expense than would be required for spraying or dusting the entire field.

Do not plow or shallow-till large tracts of sod or idle land to control grasshoppers unless you intend to



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Equipment used to load airplane for low-volume application of malathion.

seed or summer-fallow the land immediately. Cultivation ruins such land for pasture and makes it subject to soil blowing.

Seeding

In years when grasshoppers are abundant, plant small grains only on fall- or spring-tilled land, or on clean summer-fallow land. Few

grasshoppers emerge from such land.

Do not drill grain into heavily infested, unworked stubble. You will destroy only a few eggs by the seeding process. When the eggs hatch, the field will swarm with young grasshoppers. Immediate spraying of the entire field will then be necessary to save the crop.

Early spring seeding is important in reducing grasshopper damage. Early-seeded crops make considerable growth before grasshoppers hatch. They withstand a longer period of feeding than late-seeded crops. They give you a better opportunity to kill the grasshoppers with chemicals.

When small grains are ripening, flying grasshoppers frequently congregate in late-seeded crops that are still green and succulent. Those crops are often severely damaged before the grasshoppers are noticed. Well-advanced crops are much less attractive to the pests. Barley, oats, and wheat that have headed can withstand considerable defoliation without serious reduction in yield of grain.

Other Measures

Insecticides and proper tillage and seeding are the best weapons for fighting grasshoppers, but occasionally you may be able to combat the pests in other ways.

Regrassing Field Margins

Weedy field margins, including roadsides and fence rows, contain more grasshopper eggs than other

habitats. Replacing broad-leaved weeds with perennial grasses greatly reduces the number of grasshoppers in these locations. Crested wheatgrass can be used for this purpose. It is easily and quickly established and is less attractive for egg laying than native grasses.

Elimination of weeds and prevention of soil erosion are additional benefits of grassed field margins. Increased farm returns derived from the grass grown along otherwise unproductive field margins may also be of some importance.

Immune Crops

Some of the sorghums such as sorgo and kafir, after reaching a height of 8 to 10 inches, are practically immune to grasshopper attack. They can be planted rather late in the season to provide valuable feed for livestock.

Irrigation

When alfalfa and other legumes are irrigated, large numbers of grasshoppers are sometimes driven to ditchbanks and other dry places where they can be killed with spray at slight expense. Flooding hay meadows where grasshopper eggs have recently hatched will destroy many of the young grasshoppers.

The registration for the use of carbaryl on sugarbeets, malathion on sugarbeets, and naled on clover and alfalfa were at the time of publication subject to cancellation January 1, 1970. Do not use any of these insecticides on the indicated crops after January 1, 1970, without first determining whether the registration remains effective. Check with your county agricultural agent or with your State agricultural experiment station.



Prepared by

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and
Plant Pest Control Division,
Agricultural Research Service

This edition incorporates changes in insecticide recommendations that make all previous editions obsolete. For this reason, all earlier copies should be destroyed.

Washington, D.C.

Revised November 1969

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C. 20402 - Price 10 cents

U.S. GOVERNMENT PRINTING OFFICE: 1969 O-363-095